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A new species of spider fly in the genus *Sabroskya* Schlinger from Malawi, with a key to Acrocerinae world genera (Diptera, Acroceridae)

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Abstract

In this paper we diagnose the genus *Sabroskya* Schlinger, 1960 and describe *Sabroskya schlingeri* **sp. n.** from Malawi. We also provide dichotomous keys to species of *Sabroskya* and to world genera of the subfamily Acrocerinae, both extant and extinct.

Keywords

Acroceridae, spider parasitoid

Introduction

Spider flies (Diptera: Acroceridae) are a geographically cosmopolitan group although most species are relatively rarely collected. Adults have a distinctive morphology and a wide diversity of form, but typically with a small head, greatly enlarged lower calypter and swollen abdomen. Larvae are parasitoids of spiders, with a hypermetamorphic life cycle consisting of four instars (Schlinger 1981, 1987).

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Acroceridae comprise approximately 520 species in 53 genera (Pape and Thompson 2011; Gillung and Winterton 2011) occupying most biogeographic regions. The family is presently classified in three extant subfamilies based on adult morphology and host specificity with Panopinae suggested as the most primitive and Acrocerinae the most derived, with Philopotinae supposedly occupying an intermediate position (Schlinger 1987; Schlinger 2009). Recent phylogenetic analyses using DNA sequence data suggest an opposite sequence of cladogenesis and that Acrocerinae are polyphyletic (Winterton et al. 2007).

Acrocerinae comprise 17 extant and 5 extinct described genera, found in all major biogeographical regions. The subfamily is distinguished from Philopotinae and Panopinae by the following characteristics: antennae styliform, postpronotal lobes widely separated, never medially contiguous, humeral crossvein rarely well developed, and tibial apical spines absent (rarely present) (Winterton 2012). In phylogenetic analyses of DNA sequences for six sampled genera by Winterton et al. (2007), *Acrocera* Meigen, 1803 and *Sphaerops* Philippi, 1865 were recovered as a sister clade to the rest of Acroceridae. The remaining acrocerine genera sampled (i.e. *Pterodontia* Gray 1832, *Ogcodes* Latreille, 1797, *Turbopsebius* Schlinger, 1972, *Psilodera* Gray, 1832, *Holops* Philippi, 1865) were recovered in a monophyletic clade sister to Panopinae. *Acrocera* displays very different adult and larval morphology from all other acrocerids, supporting this conclusion. Yet, the placement of *Sphaerops* as sister to *Acrocera* is problematic as the adult morphology is more similar to *Villalus* Cole, 1966 than to *Acrocera* and should be re-examined using both morphology and DNA sequence data.

Six genera of Acrocerinae are known from the Afrotropical Region, including the nearly cosmopolitan genera *Acrocera*, *Ogcodes* and *Pterodontia*, as well as the endemic genera *Psilodera*, *Meruia* Sabrosky, 1950 and *Sabroskya* Schlinger, 1960. *Sabroskya* includes two previously described species from South Africa (*S. ogcodoides* Schlinger, 1960 and *S. palpalis* Barrclough, 1984) (Schlinger 1960a; Barraclough 1984) and can be readily identified from all other acrocerine genera by the presence of a cervical collar, antennae located adjacent to mouthparts, wing vein R_{4+5} straight, cell m_3 absent and discal and basal r_{4+5} cells separate and closed. Herein we describe a new species of *Sabroskya* from Malawi and present a key to species. A key to living and fossil genera of Acrocerinae of the world is also presented.

Materials and methods

Terminology follows McAlpine (1981) and Schlinger (1981) as modified by Winterton (2012). The type specimen is deposited in the collection of the Tel Aviv University (TAU). Specimen images were taken at different focal points using a digital camera and subsequently combined into a serial montage image using Helicon Focus software. High-resolution digital images were deposited into Morphbank:: Biological Imaging with embedded URL links within the document between descriptions and Morph-

bank images. All new nomenclatural acts and literature are registered in Zoobank (Pyle and Michel 2008).

Taxonomy

Key to Acrocerinae genera of the World:

The extinct genus *Juracyrtus* Nartshuk, 1996 is not included as it is represented by a compression fossil and lacks sufficient detail to be thoroughly differentiated from other genera. Two recently described genera, *Schlingeromyia* Grimaldi & Hauser, 2011 and *Burmacyrtus* Grimaldi & Hauser, 2011, from Cretaceous aged amber (Grimaldi et al. 2011) are included here in Acrocerinae based on the presence of stylate antennae, non-arched body shape and widely separated postpronotal lobes. The placement of *Burmacyrtus* in Acroceridae is problematic and should be reassessed as this genus lacks characters typical of acrocerids, including a mediolobus and wing crossvein 2r-m, and has a relatively small calypter. Based on these characters, placement in Heterodactyla should be considered rather than in Acroceridae, although a stem-group position for the genus as suggested by Grimaldi et al. (2011) may also be reasonable.

1 Cell m_3 present and well formed (Fig. 1A) **2**

– Cell m_3 clearly absent (Figs 1B, 2–3), *or*, fusion of m_3 with discal cell indicated by presence of spur veins (rare) **10**

2 Antennae not adjacent to the ocellar tubercle; located on middle of frons, separated from ocellar tubercle by distance much greater than length of ocellar tubercle (Figs 3C, 5) **3**

– Antennae adjacent to the ocellar tubercle **5**

3 Wing vein R_{4+5} forking from R_{2+3} in distal half of cell r_{4+5}; cells bm and br fused into a single cell; cell r_{4+5} relatively broad; eye emarginate (Burmese Amber) ..... ***Schlingeromyia*** **Grimaldi & Hauser, 2012**

– Wing vein R_{4+5} forking from R_{2+3} before or at base of cell r_{4+5}; cells bm and br separate; cell r_{4+5} relatively narrow along entire length; eye not emarginate .. **4**

4 Eyes apilose; radial veins curved anteriorly, joining to anterior margin of wing (Southern Africa) ..... ***Psilodera*** **Gray, 1832**

– Eyes pilose; radial veins relatively straight, joining wing apex (Chile) ..... ***Holops*** **Philippi, 1865**

5 Eyes very sparsely pilose, few microscopic setae present (India) ..... ***Subcyrtus*** **Brunetti, 1926**

– Eyes densely pilose **6**

6 Mouthparts longer than head; palpi present; proboscis not pilose 7

– Mouthparts shorter than head; palpi apparently not present; proboscis pilose (Fig. 3C) **8**

7 Antennae separated form ocellar tubercle by small depression (Europe) (Fig. 1A [wing]) ..... ***Cyrtus* Latreille, 1797**

– Antennae not separated from ocellar tubercle by depression (China) ..... ***Paracyrtus* Schlinger, 1972**

8 Mouthparts very short, barely protruding from oral cavity (Palaeartic)..... ***Asopsebius* Nartshuk, 1982**

– Mouthparts longer, protruding from oral cavity, but not longer than head **9**

9 Labellum present; abdominal spiracles II - IV placed in intersegmental membranes (Taiwan) ..... ***Hadrogaster* Schlinger, 1972**

– Labellum absent; abdominal spiracles II - IV placed in corresponding sternites (Taiwan and Japan) ..... ***Nipponcyrtus* Schlinger, 1972**

10 Antennae located on upper half of head, usually proximal to ocellar tubercle...**11**

– Antennae located on lower half of head, adjacent to oral cavity.....**17**

11 Vein R_{4+5} represented as a single unforked vein **12**

– Veins R_4 and R_5 forked and petiolate basally (R_4 rarely incomplete basally) ... **14**

12 Eyes minutely pilose, setae barely evident; petiolate to wing margin; flagellum with minute terminal seta; male genitalic capsule enlarged and bulbous (Chile) (Fig. 1B) ..... ***Sphaerops* Philippi, 1865**

– Eyes clearly pilose; flagellum with relatively large terminal seta; male genitalic capsule not enlarged or bulbous.....**13**

13 Microtrichia on the wing membrane absent; A_1 joined to wing margin separate from CuA_2 (Baltic Amber) ..... ***Villalites* Hennig, 1966**

– Microtrichia on the wing membrane present; A_1 and CuA_2 approximated distally but incomplete, not joined to wing margin (Chile)..... ***Villalus* Cole, 1918**

14 Wing with single medial vein (M_3?); cell bm only well defined, other cells reduced or merged to form single cell open basally; alula well developed (most biogeographic regions) ..... ***Acrocera* Meigen, 1803**

– Wing with three medial veins originating from discal cell; wing with three or four wing cells well defined; alula present or absent **15**

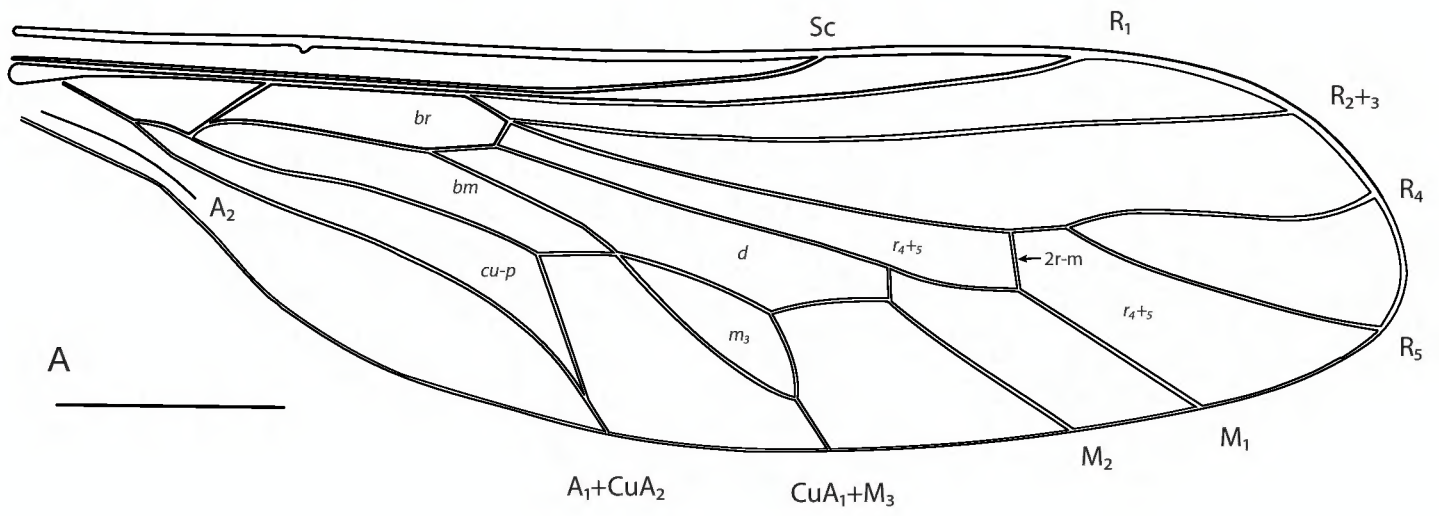
15 Mediolobus absent; crossvein 2r-m absent so that only three closed wing cells present; antennal style longer than rest of flagellum (Burmese Amber)..... ***Burmacyrtus* Grimaldi & Hauser, 2011**

– Mediolobus present and similar shaped to pulvilli; crossvein 2r-m present so that four closed wing cells are present; antennal style shorter than rest of flagellum.....**16**

16 Anterior ocellus reduced but present; costa circumambient; male wing with anterior costal process (Nearctic) ..... ***Turbopsebius* Schlinger, 1972**

– Anterior ocellus absent; costa ending in radial field near wing apex; male wing without anterior process (Palaearctic)..... ***Opsebius* Costa, 1855**

17 Wing with remnants of cell m_3 indicated by presence of spur veins in cell $d+m_3$ (Hennig 1968: figs 5, 8) (Baltic Amber)..... ***Glaesoncodes* Hennig, 1968**



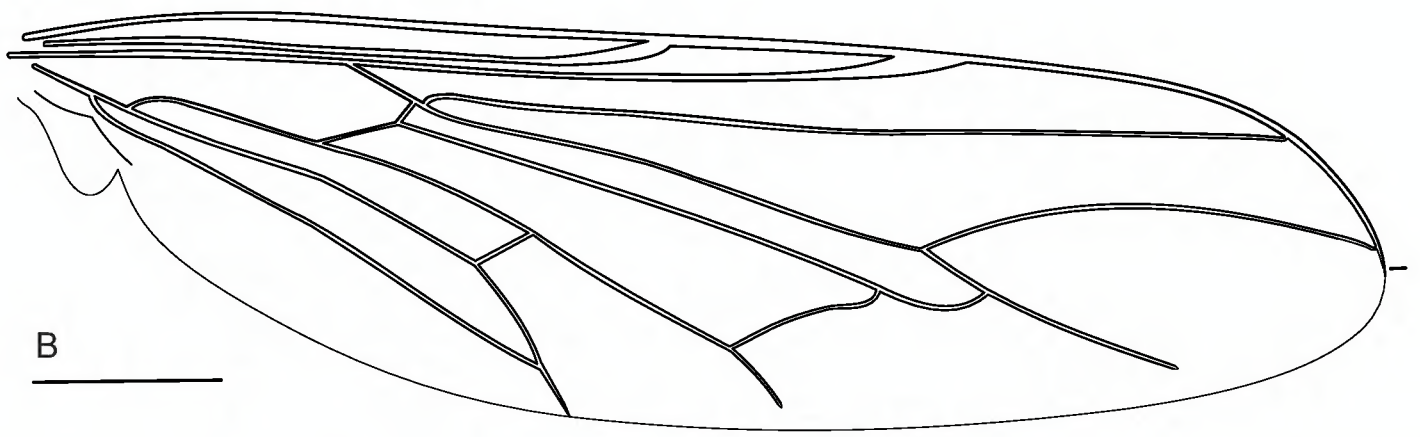


Figure 1. Acroceridae wings. Acrocerinae: **A** *Cyrtus gibbus* (Fabricius, 1794) **B** *Sphaerops appendiculata* Philippi, 1865. Scale line = 0.2 mm.

– Wing cell m_3 not indicated by spur veins **18**

18 Wing cells d and basal r_{4+5} separate; antepronotum produced anteriorly as collar-like process behind head (Schlinger 1960a: fig. 13) **19**

– Wing cells d and basal r_{4+5} (and m_3) fused to form large single cell (Fig. 2B), or cells absent (Fig. 2A); antepronotum not forming collar-like process behind head **20**

19 Thorax greatly enlarged dorsally; wing veins R_{2+3} and R_{4+5} curved anteriorly then reflexed towards wing apex; vein M_2 reaching wing margin; alula absent (Kenya) (Sabrosky 1950: fig. 2a) ..... ***Meruia*** **Sabrosky, 1950**

– Thorax rounded but not greatly enlarged; radial veins straight; vein M_2 not reaching wing margin; alula present (southern Africa) (Figs 3–10) ..... ***Sabroskya*** **Schlinger, 1960**

20 Tibial spines present apically; mouthparts present (Cosmopolitan) (Fig. 2B) ..... ***Pterodontia*** **Gray, 1832**

– Tibial spines absent; mouthparts absent, oral cavity closed (Cosmopolitan) (Fig. 2A) ..... ***Ogcodes*** **Latreille, 1797**

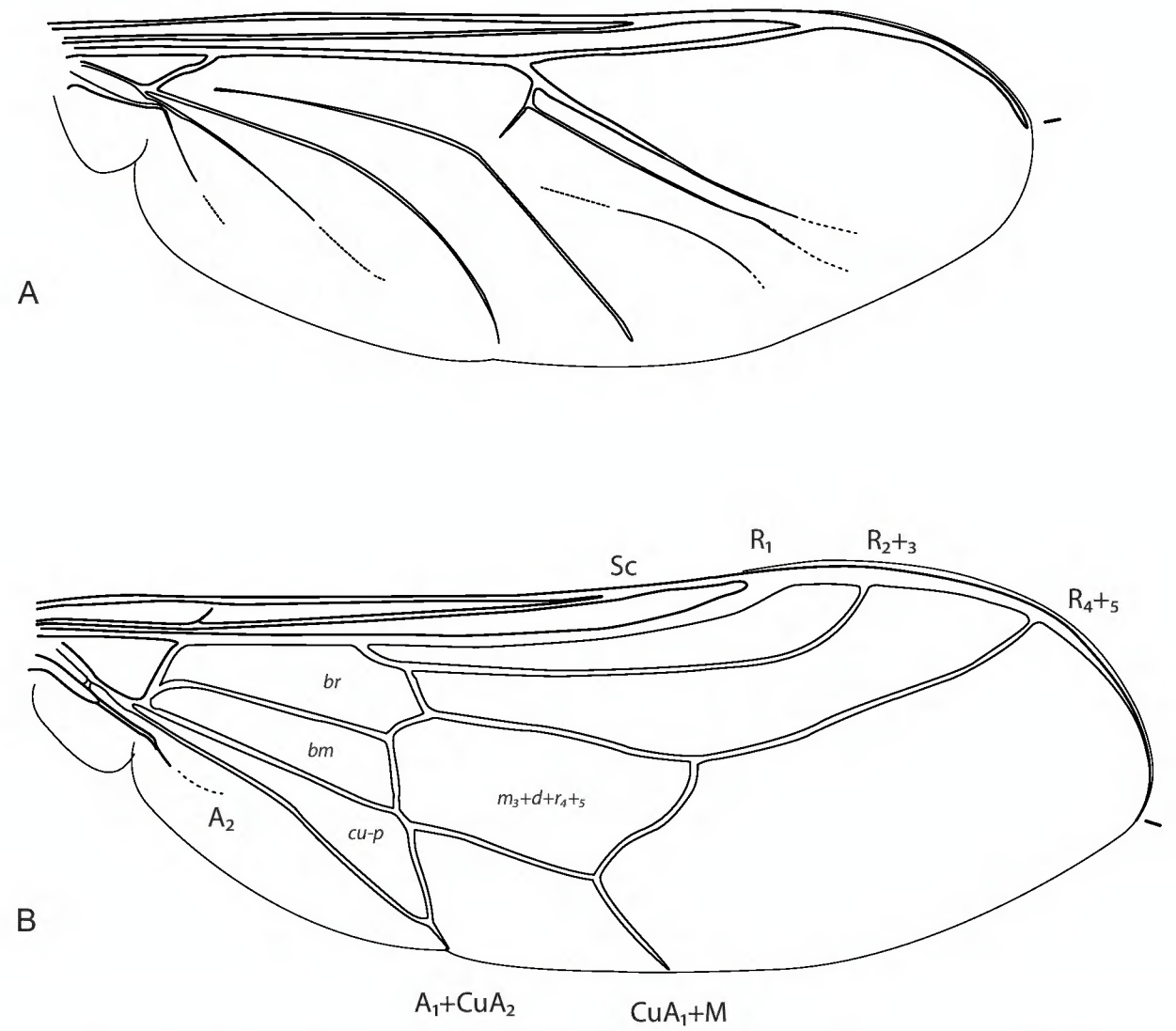


Figure 2. Acroceridae wings. Acrocerinae: **A** *Ogcodes basalis* Walker, 1852 **B** *Pterodontia davisi* Paramonov, 1957 (female). Scale line = 0.2 mm.

Sabroskya Schlinger

http://species-id.net/wiki/Sabroskya

Type species. *Sabroskya ogcodoides* Schlinger 1960: 479 by original designation.

Diagnosis. Body length: 6.0–7.0 mm. Body shape not arched. Head width slightly narrower than thorax; sub-spherical; postocular ridge and occiput rounded; three ocelli; posterior margin of eye rounded; eye pilose (dense); eyes contiguous above antennal base; antennae located adjacent to mouthparts; palpus present or absent; proboscis length less than head length, with sparse setal pile; flagellum stylate, apex with relatively large terminal seta; postpronotal lobes not enlarged or contiguous medially; antenotum expanded, collar-like behind head; subscutellum relatively enlarged; tibial spines absent; pulvilli present; wing hyaline or slightly smoky infuscate, markings absent; costa ending near wing apex; costal margin straight; humeral crossvein absent; R_1 very slightly inflated at pterostigma; R_{2+3} present or absent; veins R_4 and R_5 present as single vein R_{4+5}; radial veins straight, complete to wing margin; crossvein 2r-m present between M_1 and R_{4+5}, bisecting cell r_{4+5}, cell formed by 2r-m narrow elongate; medial vein compliment: M_1, M_2 and M_3 present (M_3 fused with CuA_1), medial veins may or

may not reach wing margin; discal cell closed completely; cell m_3 absent; CuA_2 fused to A_1 before wing margin, petiolate; wing microtrichia absent; anal lobe well developed; alula well developed; abdominal tergites smooth, rounded; abdomen rounded, inflated, slightly wider than thorax.

Comments. *Sabroskya* is a highly specialized Acrocerinae spider fly genus morphologically similar to *Meruia*, *Ogcodes, Glaesoncodes* and *Pterodontia*. These five genera all have stylate antennae located on the lower side of the head adjacent to the often reduced or absent mouthparts. Other acrocerine genera related to this clade include *Turbopsebius*, *Opsebius*, *Villalus*, *Acrocera* and *Sphaerops*, all of which have a wing venation lacking cell m_3. The Baltic amber genus *Glaesoncodes* is unique among this acrocerine clade as the wing retains remnants of cell m_3, with spur veins present in cell $d+m_3$ (Hennig 1968); similar remnants of m_3 can also be found in more distantly related *Turbopsebius*. This provides important insights into the evolution of acrocerid wing venation, suggesting rampant reduction in number of cells and veins through loss or fusion, and can be found in derived clades in all three extant subfamilies (Winterton et al. 2007; Gillung and Winterton 2011).

In *Pterodontia*, *Sabroskya* and *Ogcodes* the costal margin has a membranous rim or flange between R_1 and wing apex (Figs 2–3). This character still needs to be confirmed in *Meruia*, but appears to be likely a synapomorphy for the group. The putative sister genus to *Sabroskya* is *Meruia*, and both have similar wing venation comprising well defined and complete discal and basal r_{4+5} wing cells. These cells are absent in *Ogcodes* and are fused to form a single cell in *Pterodontia*. *Sabroskya* can be immediately identified from other acrocerine genera by the presence of a cervical collar, antennae located adjacent to mouthparts, R_{4+5} straight, cell m_3 absent and discal and basal r_{4+5} cells separate and closed.

Schlinger (1960a) described the antennal flagellum of *Sabroskya* as stylate without a terminal seta, and with a large subterminal seta on the lateral surface of the flagellum. Detailed examination of the topotype series of *S. ogcodoides* (Schlinger 1960b) shows a similar condition as found in both *S. schlingeri* sp. n. and *S. palpalis*, with the flagellum actually having large terminal setae present (Fig. 3C) (see also Grimaldi (1995: fig. 5)). Only in *S. palpalis* are palpi present while in *S. ogcodoides* and *S. schlingeri* sp. n., the palpi are absent.

Included species. *Sabroskya ogcodoides* Schlinger, 1960; *S. palpalis* Barraclough, 1984; *S. schlingeri* sp. n.

Key to species of *Sabroskya*. (Females are unknown for *S. palpalis* and *S. schlingeri* sp. n.)

1 Flagellum with subterminal setae absent; palpi present; posterior surface of hind coxae apilose; paler areas of male abdominal tergites not connected medially (South Africa).....***S. palpalis* Barraclough, 1984**

– Flagellum with subterminal setae present (Fig. 3C); palpi absent; posterior surface of hind coxae pilose; paler areas of male abdominal tergites connected medially.....**2**

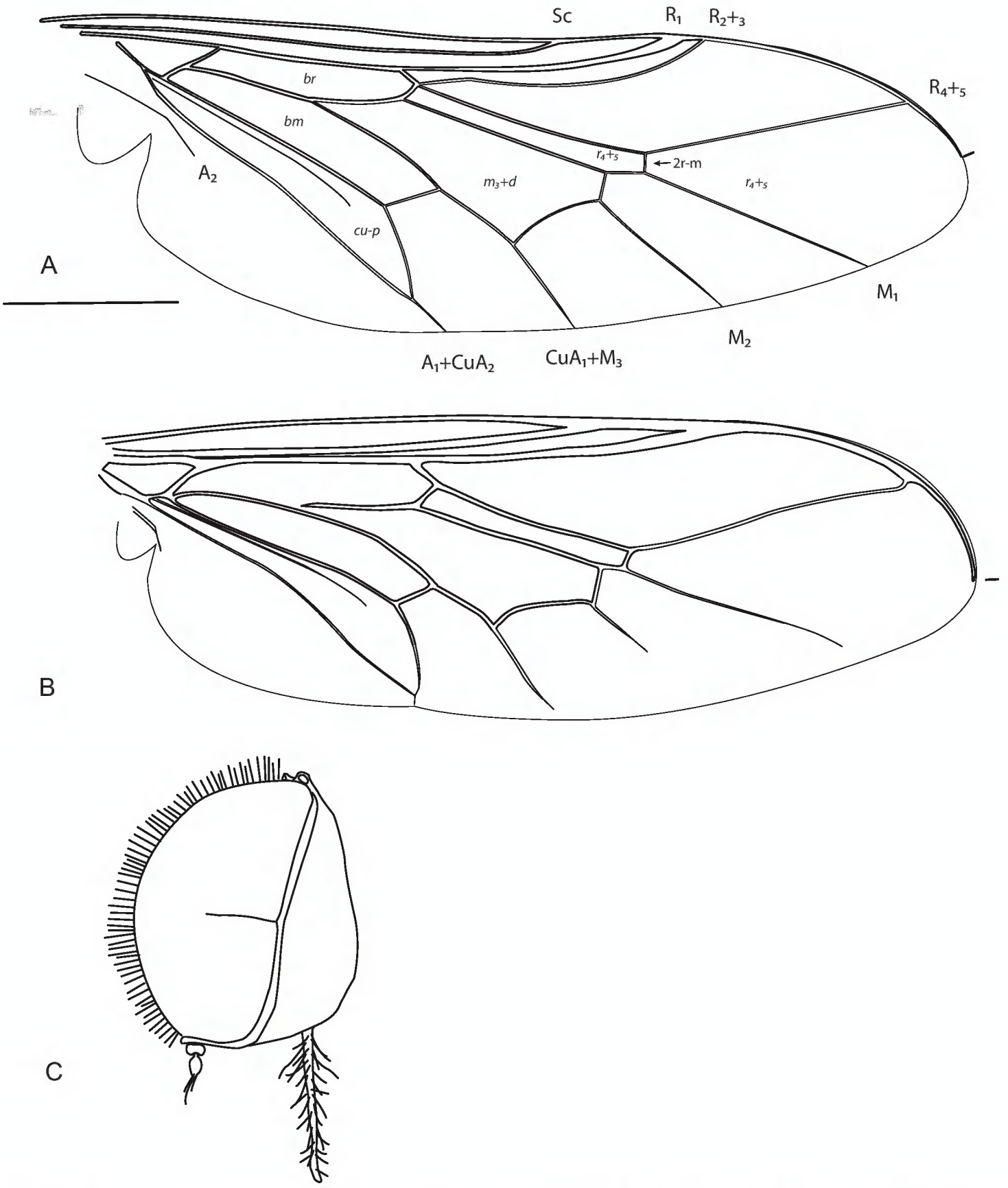


Figure 3. Acrocerinae: A, *Sabroskya ogcodoides* Schlinger, 1960a; B, *Sabroskya schlingeri* sp. n.; C, *Sabroskya schlingeri* sp. n., male head, lateral view. Scale line = 0.2 mm.

2 Male wing venation brown; vein R_{2+3} absent (Fig. 3B); wing smoky infuscate anteriorly; thoracic, abdominal and lower calypter pile dark (Malawi) (Figs 3–6) ... . ***S. schlingeri* sp. n.**

– Male wing venation white, brown in female; vein R_{2+3} present (Fig. 3A); wing hyaline; thoracic, abdominal and lower calypter pile white (South Africa) (Figs 7–10) ..... ***S. ogcodoides* Schlinger, 1960**

Figure 4. *Sabroskya schlingeri* sp. n., male, oblique view [Morphbank: 705550]. Body length = 5.0 mm.

***Sabroskya schlingeri* sp. n.**
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http://species-id.net/wiki/Sabroskya_schlingeri
Figures 3B, 3C, 4–6

Type material. Holotype male, MALAWI: Northern Province: North Viphya Mts, 1500 m, Rt. M1, 21–22.ix.1998, 10 km S Chikangawa [-11.929, 33.747], F. Kaplan, A. Freidberg (TAU).

Diagnosis. Wing venation black; vein R_{2+3} absent; wing hyaline, smoky infuscate anteriorly; flagellum with subterminal seta present; lower calypter pile short, dark;

Figure 5. *Sabroskya schlingeri* sp. n., male, lateral view [Morphbank: 705551]. Body length = 5.0 mm.

thoracic and abdominal pile black; palpi absent; hind coxae with setae on posterior surface; paler areas of abdominal tergites connected medially.

Description. Body length 5.0 mm (male). *Head.* Eye brown, densely pilose with setae approximately length of tarsal claw; posterior margin of eye not emarginate; ocellar tubercle glossy black and raised around ocelli; occiput glossy black, coriacious, pile black; postocular ridge, gena to parafacial with narrow grey pubescent ridge; palpus absent; margin of oral cavity apilose; proboscis shorter than head length (Fig. 3C); antenna brown; flagellum apex with relatively elongate terminal seta, subterminal seta(e) present laterally. *Thorax.* Scutum glossy black with bronze suffusion anteriorly, postalar callus yellowish; vestiture as dense brown-black pile, paler on postalar callus; scutellum glossy black with dense black pile; pleuron glossy black with brown to yellowish pile; coxae black with yellow pile; femora dark yellow with black suffusion basally, pile yellow; tibiae yellow with short yellow pile; tarsi yellow; lower calypter hyaline with darkish margin; pile on membrane and along rim yellow to brown; wing hyaline, slightly smoky infuscate anteriorly, venation dark; vein R_{2+3} absent (Fig. 3B); M_2 very short. *Abdomen.*

Figure 6. *Sabroskya schlingeri* sp. n., male, dorsal view [Morphbank: 705552]. Body length = 5.0 mm.

Elongate globose, slightly wider than thorax, tergites dark brown anteriorly, yellow laterally and meeting posteromedially; covered with brown-black setae, erect and tufted medially on each tergite. Male genitalia: not dissected, externally similar to *S. ogcodoides*.

Etymology. The specific epithet is named in honor of Evert I. Schlinger, a foremost expert on world Acroceridae taxonomy and patron of dipterology. Evert Schlinger had previously identified that this specimen represented a new species of *Sabroskya*.

Comments. *Sabroskya schlingeri* sp. n. is known only from a single male specimen from Malawi. A label on the pin of the holotype indicates that E. I. Schlinger had recognized that this species was a new taxon separate from the two previously described species. This is the most northern record for the genus, with both previously described species recorded from Eastern Cape and KwaZulu-Natal Provinces of South Africa. The lack of vein R_{2+3}, dark vestiture and wing venation, and smoky infuscate wing readily differentiate this species from *S. palpalis* and *S. ogcodoides.*

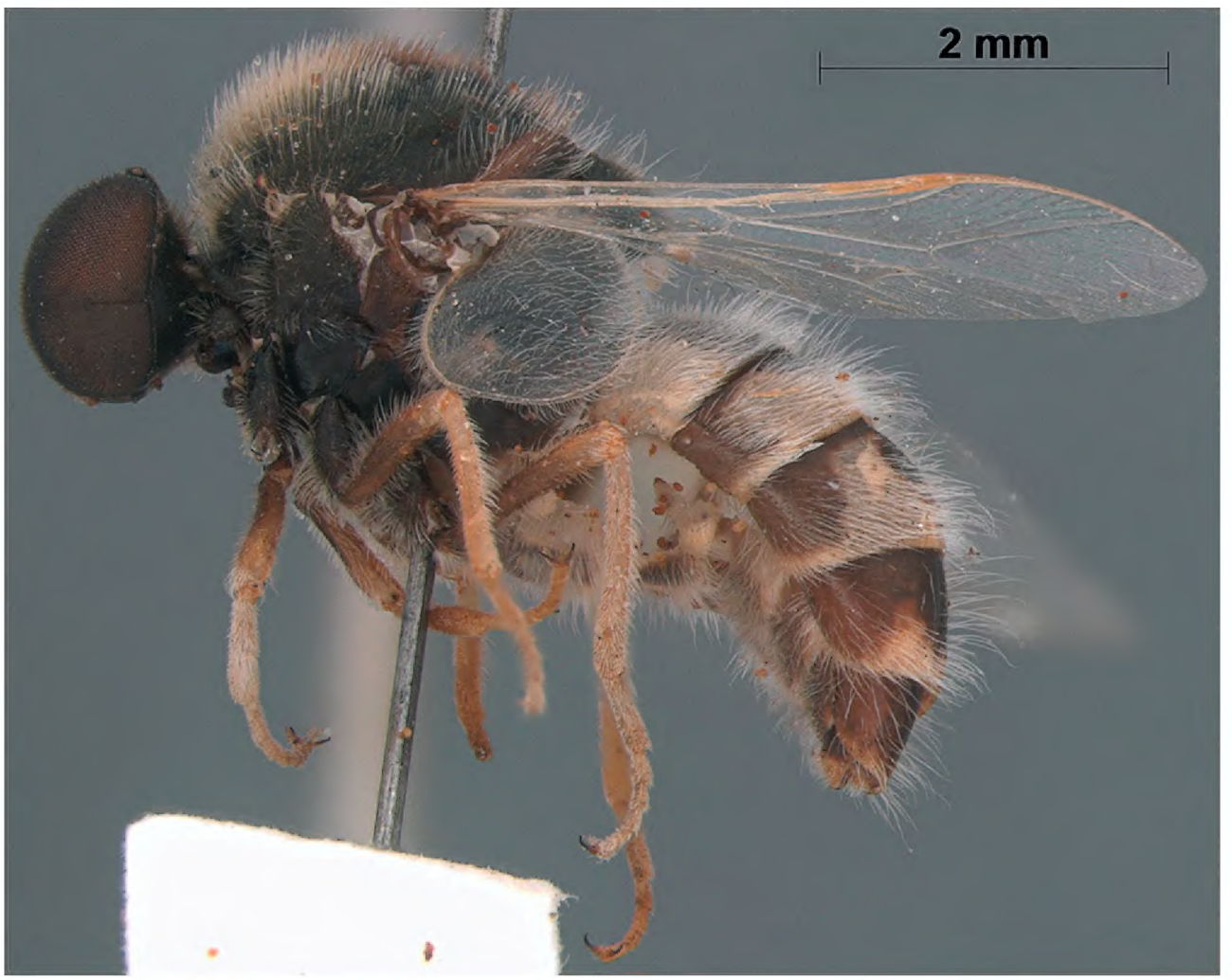

Figure 7. *Sabroskya ogcodoides* Schlinger, male, lateral view.

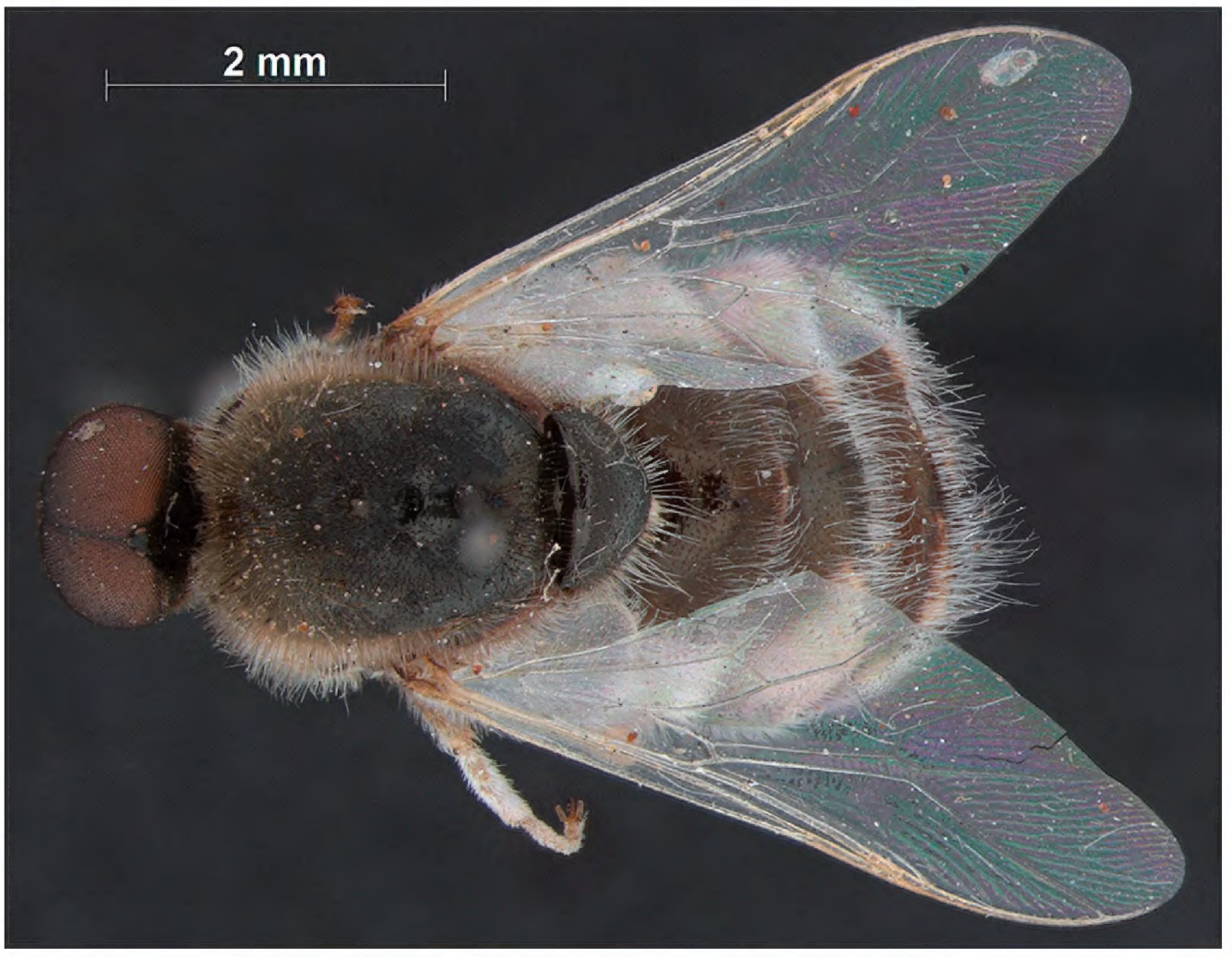

Figure 8. *Sabroskya ogcodoides* Schlinger, male, dorsal view.

Figure 9. *Sabroskya ogcodoides* Schlinger, female, lateral view.

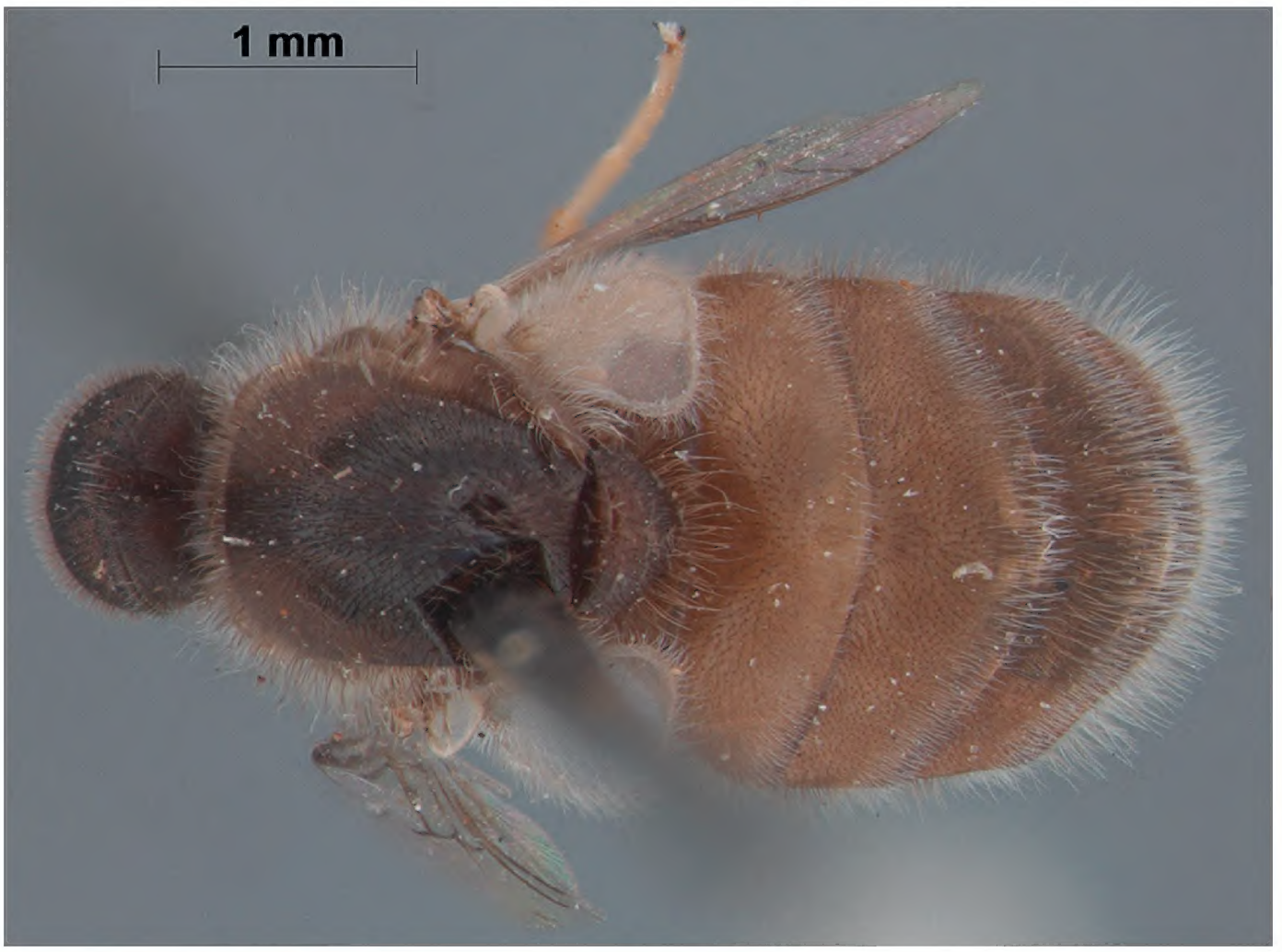

Figure 10. *Sabroskya ogcodoides* Schlinger, female, dorsal view.

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